The Role of Citizen Science and Crowdsourcing Tools in Supporting Systems Analysis at IIASA

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Background

The involvement of citizens in scientific activities from data collection to hypothesis generation is referred to as **citizen science**. The majority of citizen involvement tends to be on the data collection side, where numerous crowdsourcing platforms have been built to involve citizens in image interpretation, online mapping and other micro-tasks that would not otherwise have been possible. There has been increasing attention directed towards how citizen-contributed data can be used for improved calibration and validation of satellite-derived products, such as land cover, as well as data for modelling purposes. Here we showcase examples of tools and applications in the area of citizen science and crowdsourcing within the EOS group of IIASA's ESM program. These tools include:

1 **Geo-Wiki Engagement Platform**

2 **Serious Gaming Applications**

3 **Improved Land Cover/Land Use Products**

4 **Support to Integrated Assessment Models**

1. Geo-Wiki Engagement Platform

Geo-Wiki[1] is an open platform that provides citizens with the means to engage in environmental monitoring by providing feedback on existing land cover products overlaid on high resolution satellite imagery [1]. Data can be contributed via the traditional desktop platform or mobile devices, with campaigns and games used to incentivize data collection and stimulate community building.
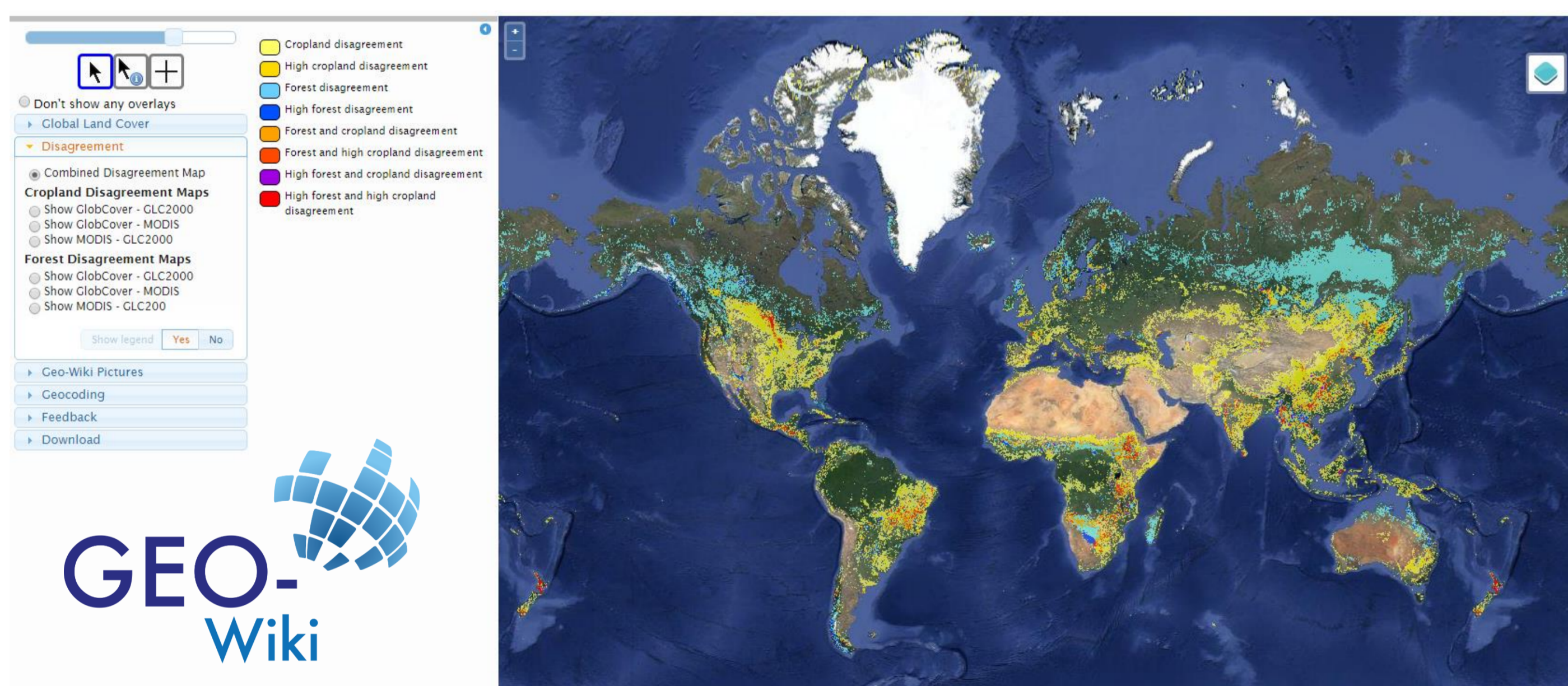
- 6 crowdsourcing campaigns
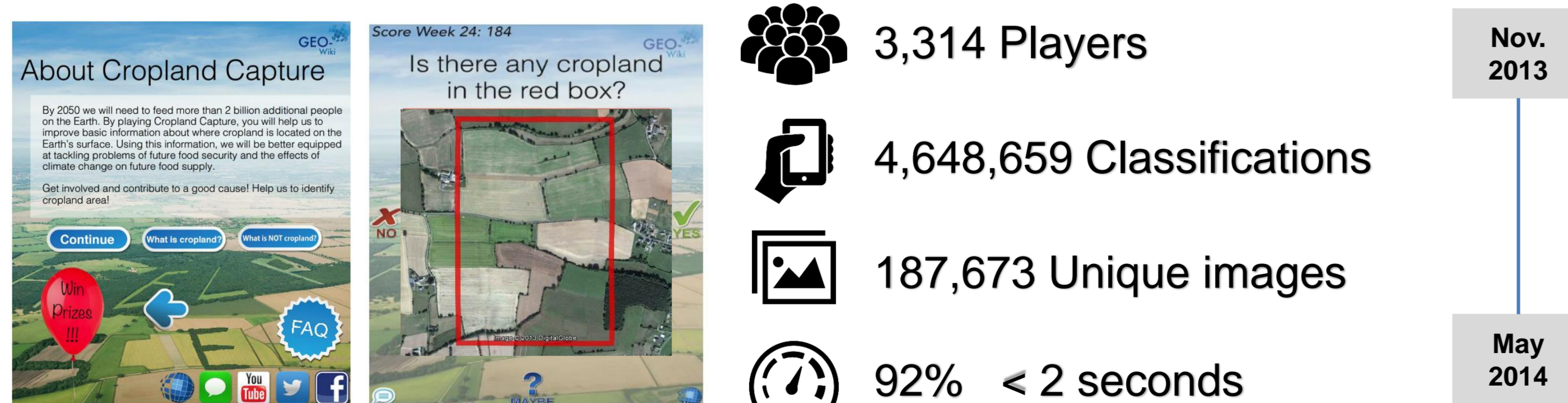- 250,000+ validation points
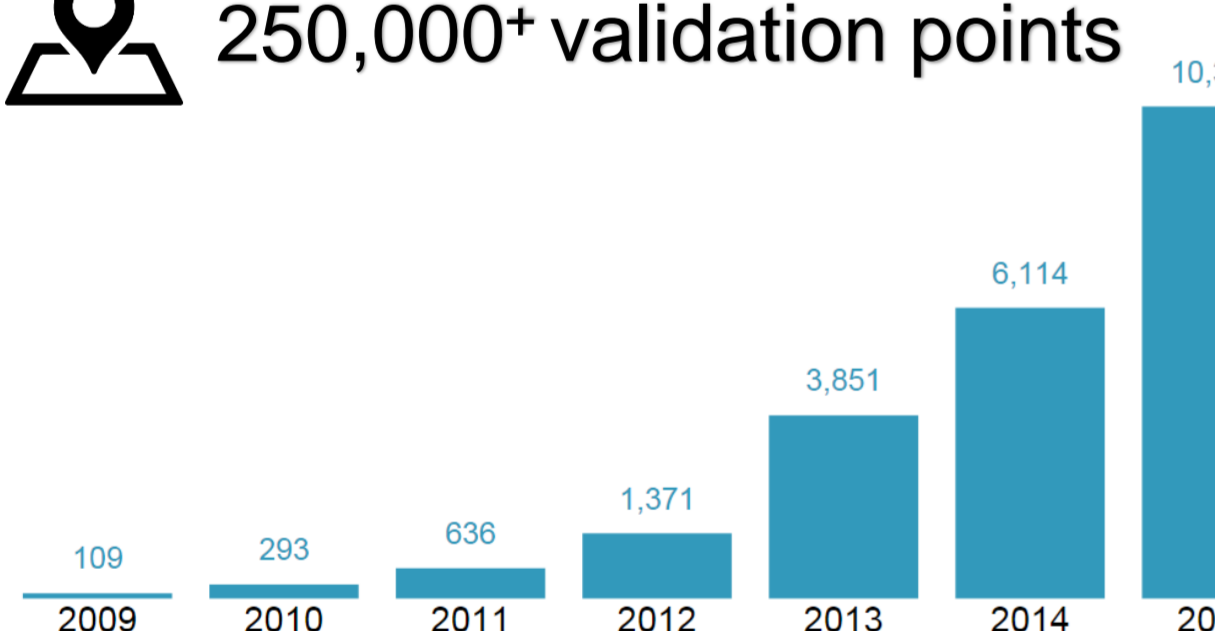
10,000+ registered Geo-Wiki users

User interface of Geo-Wiki platform

2. Serious Gaming Applications

Cropland Capture[2] was launched in mid-November 2013 and ran until the beginning of May 2014 as a multi-platform game in which players were asked to determine if there was any evidence of cropland on imagery (satellite and ground-based photographs). The mobile device interface was designed so that players swipe the images into three possible categories of Yes, No or Maybe. For each correct answer, the player received a single point while one point was deducted for incorrect answers. Correctness was determined through majority agreement although there was an option to challenge the crowd.

- 3,314 Players
- 4,648,659 Classifications
- 187,673 Unique images
- 92% < 2 seconds

Nov. 2013 — May 2014

Picture Pile[3] is the successor to Cropland Capture and has been designed to be more generic to address other land cover types as well as temporal change detection. Players classify different piles of pictures, each covering a specific theme such as deforestation, oil palm detection, or cropland extent. Each pile has an associated leaderboard and a chat channel, facilitating open communication between players and organizers as well as stimulating a citizen science community.
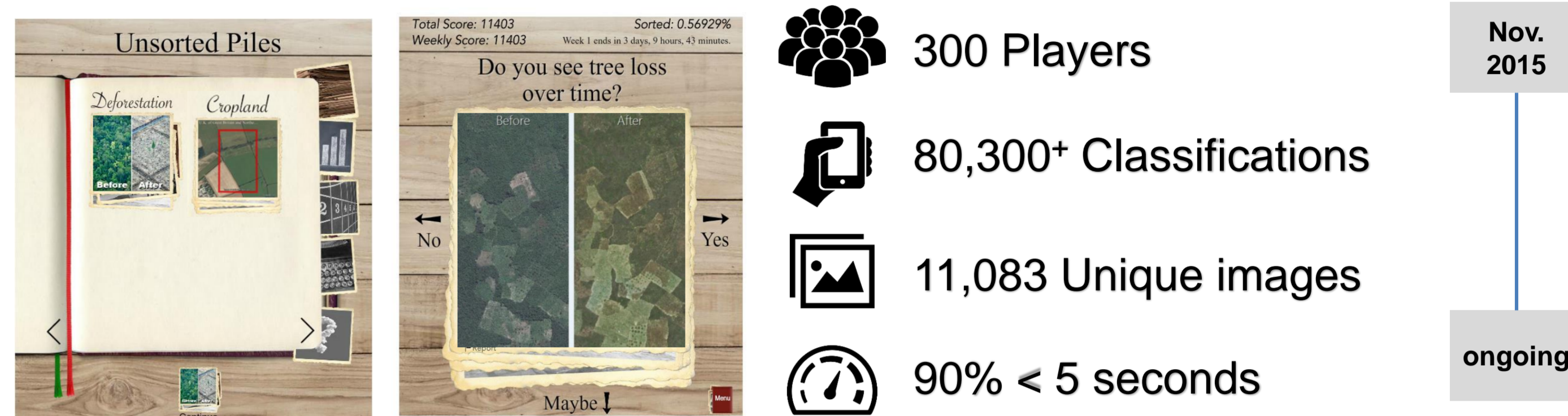
- 300 Players
- 80,300+ Classifications
- 11,083 Unique images
- 90% < 5 seconds

Nov. 2015 — ongoing

FotoQuest Austria[4] is a mobile app launched in July 2015 that asks players to travel to specific points of interests (i.e. undertake quests) in their nearby surroundings. To complete their quest, players are prompted to take photographs of the ground and in 4 cardinal directions at each specified location, and classify the *in-situ* land cover based on the EU's LUCAS (*Land Use and Cover Area frame Survey*) protocol. The first version of the app was aimed at a German-speaking audience with a campaign running until September 2015. We are currently working on scaling up this app to additional EU countries via the EU COST network TD1202: Mapping and the Citizen Sensor[5].
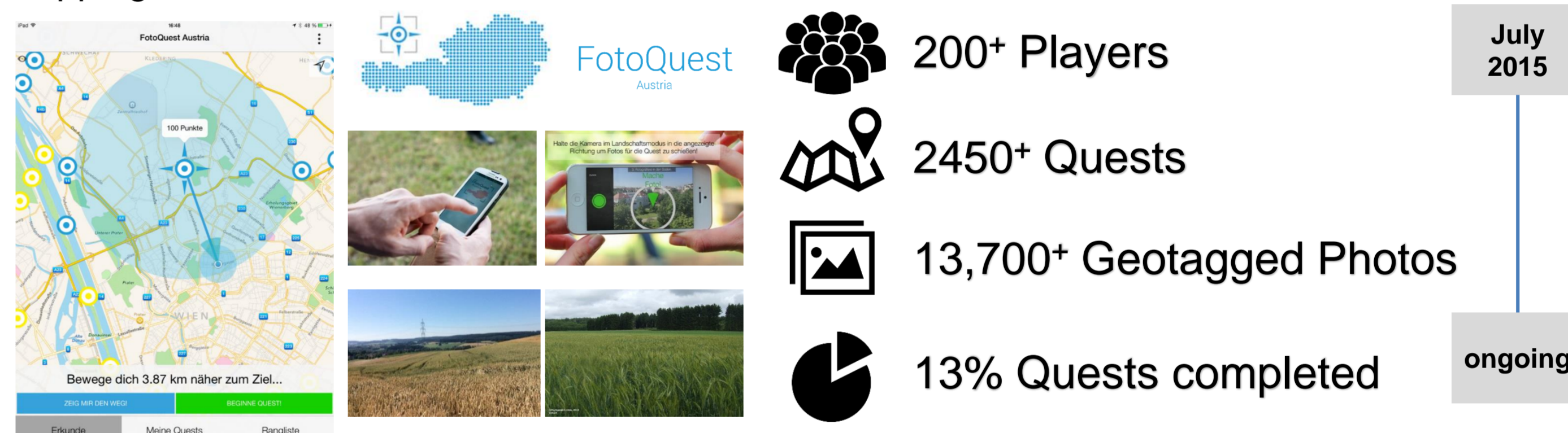
- 200+ Players
- 2450+ Quests
- 13,700+ Geotagged Photos
- 13% Quests completed

July 2015 — ongoing

3. Improved Land Cover/Land Use Products

Data collected from Geo-Wiki crowdsourcing campaigns and serious gaming applications have led to improved global maps of cropland, forest cover, and land cover distributions. The global cropland map is used for GLobal Agricultural Monitoring by GEOGLAM, a flagship initiative of the Group on Earth Observations (GEO). This product has been jointly produced by IIASA and the International Food Policy Research Institute (IFPRI) as an input to maps of crop type distribution for 40 major crops around the world. Crowdsourcing campaigns have also collected data on the size of cropland fields to produce the first global map of field size, freely available on the Geo-Wiki engagement platform [2].
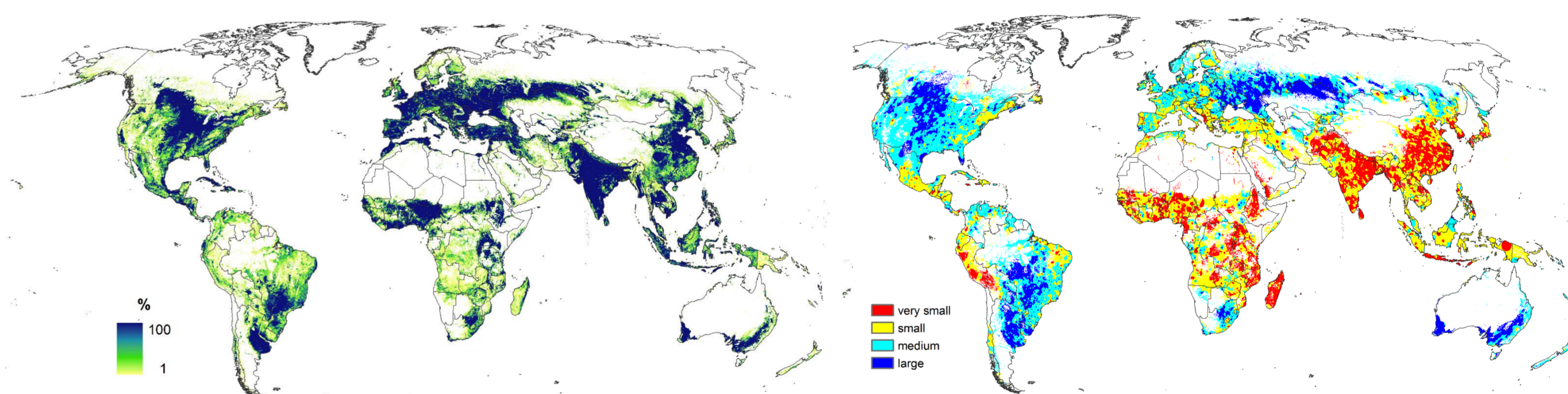
Global Cropland Map

Global Field Size Map

4. Support to Integrated Assessment Models

Such quality assured products provide valuable inputs to integrated assessment models such as IIASA's Global Biosphere Management Model (GLOBIOM). These products help GLOBIOM to accurately model the current competition for land use between agriculture, livestock, bioenergy and forestry sectors, as well as forecast future food demand and market trends.

Citizens — Researchers — Improved Land Cover/Land Use Products — GLOBIOM

GLOBIOM: Demand / Markets / Supply

Population Growth, GDP, Consumer Preferences

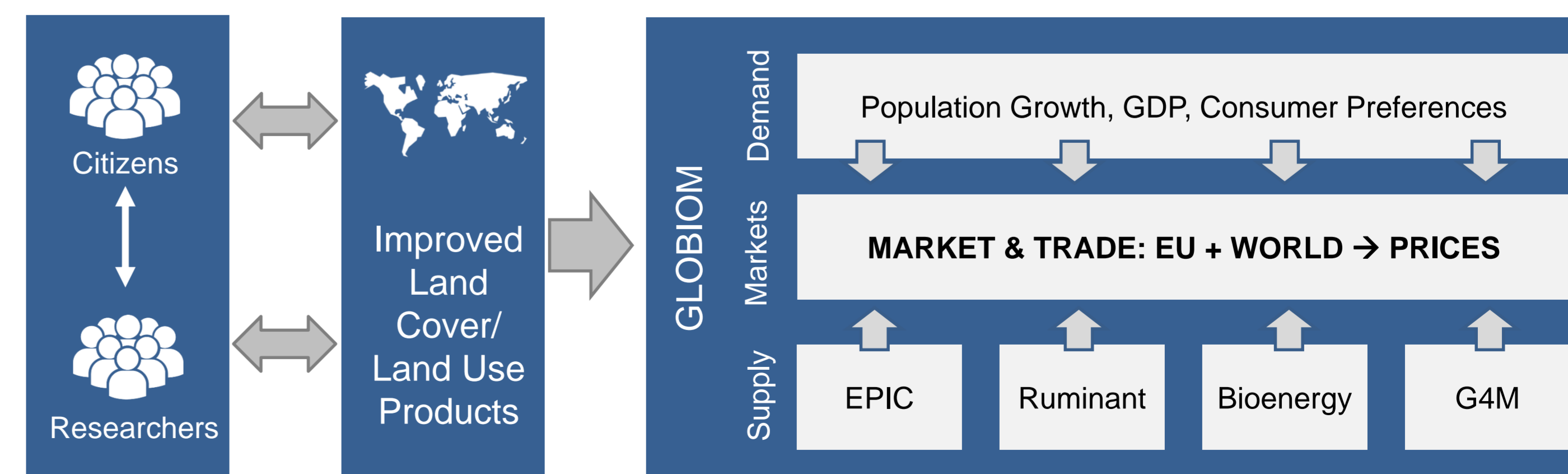MARKET & TRADE: EU + WORLD → PRICES

EPIC | Ruminant | Bioenergy | G4M

References

[1] Fritz S., McCallum, I., Schill, C., Perger, C., See, L., Schepaschenko, D., Kraxner, F., Obersteiner, M. (2012). Geo-Wiki: An online platform for improving global land cover. *Environmental Modelling and Software*. V.31: 110-123 .

[2] Fritz, S., et al (2015), Mapping global cropland and field size. *Global Change Biology*, 21: 1980–1992.

Websites

1. http://www.geo-wiki.org/
2. http://geo-wiki.org/oldgames/croplandcapture
3. http://geo-wiki.org/games/picturepile
4. http://fotoquest.at/
5. http://www.citizensensor-cost.eu/

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